4. SUMMARY OF SOUTH PACIFIC AND SOUTH INDIAN OCEAN TROPICAL CYCLONES

4.1 GENERAL

On 1 October 1980 JTWC's area of responsibility (AOR) was expanded to include the Southern Hemisphere from 180° longitude westward to the coast of Africa. Details on Southern Hemisphere tropical cyclones and JTWC warnings from July 1980 through June 1982 are contained in Diercks *et al.* (1982) and from July 1982 through June 1984, in Wirfel and Sandgathe (1986). Information on Southern Hemisphere tropical cyclones after June 1984 can be found in the applicable Annual Tropical Cyclone Report.

The Naval Western Oceanography Center (NWOC) Pearl Harbor, HI issues warnings on tropical cyclones in the South Pacific east of 180° longitude. Tropical cyclones in NWOC's AOR are included in this and previous Annual Tropical Cyclone Reports.

In accordance with USCINCPACINST 3140.1 (series), Southern Hemisphere tropical cyclones are numbered sequentially from 1 July through 30 June. This convention is established to encompass the Southern Hemisphere tropical cyclone season, which normally occurs from January through April. There are two ocean basins for warning purposes - the South Indian (west of 135° east longitude) and the South Pacific (east of 135° east longitude) - which are identified by appending the suffixes "S" and "P" respectively to the tropical cyclone number.

CAVEAT: Intensity estimates for Southern Hemisphere tropical cyclones are derived from the evaluation of satellite imagery (Dvorak, 1984) and in rare instances by surface observations. Estimates for minimum sea-level pressure are derived by applying the Atkinson and Holliday (1977) relationship between maximum sustained one-minute average surface wind and minimum sea-level pressure (Table 4-1) to the intensity estimates derived from satellite imagery. Note: This relationship was based on data from the western North Pacific. A modified relationship has been adopted for the Atlantic basin.

4.2 SOUTH PACIFIC AND INDIAN OCEAN TROPICAL CYCLONES

After a below average number of tropical cyclones in 1988, 1989 (Table 4-2) activity rose to the near climatological mean of 27 storms (Table 4-3). A comparison of tropical cyclone activity for these two years shows that both started in the beginning of November and ended by mid-May. Although December 1989 proved to be below average with only one tropical cyclone in a month which normally has three, the multiple outbreaks (Figure 4-1) in late February and in the late March/early April timeframe resulted in the total being near normal. During the year, two tropical cyclones achieved super typhoon intensity—Harry (10P) and Orson (26S). Harry (10P) also shared the

TABLE 4-1 MAXIMUM SUSTAINED SURFACE WINDS AND EQUIVALENT MINIMUM SEA-LEVEL PRESSURE (ATKINSON AND HOLLIDAY, 1977)

MAXIMUM SUSTAINED SURFACE WIND (KT)	MINIMUM SEA-LEVEL PRESSURE (MB)
30	1000
35	997
40	994
45	991
50	987
55	984
60	980
65	976
70	972
75	967
80	963
85	958
90	954
95	948
100	943
105	938
110	933
115	927
120	922
125	916
130	910
135	906
140	898
145	892

distinction of requiring warnings for almost two weeks with Barisaona (02S) and Hanitra (11S). A comparison of activity by basin appears in Table 4-4. Plots of the tropical cyclone best tracks are provided in Figures 4-2 and 4-3.

TABLE 4-2 **SOUTH PACIFIC AND SOUTH INDIAN OCEANS 1989 SIGNIFICANT TROPICAL CYCLONES (1 July 1988 - 30 June 1989)**

TROPICAL CYCLONE	PERIOD OF WARNING	NUMBER WARNINGS ISSUED	MAXIMUM SURFACE WINDS-KT (M/SEC)	ESTIMATED MSLP (MB)
01S ADELININA	01 NOV - 04 NOV	9	75 (39)	968***
02S BARISAONA	08 NOV - 20 NOV	26	100 (51)	944***
03S ILONA	13 DEC - 18 DEC	10	85 (44)	958
04P DELILAH	01 JAN - 03 JAN	4	60 (31)	980
05P GINA	07 JAN - 09 JAN	6**	45 (23)	991
06S - - - -	10 JAN - 14 JAN	9	75 (39)	968***
07S EDME	20 JAN - 25 JAN	11	115 (59)	927
08S FIRINGA	26 JAN - 01 FEB	14	90 (46)	954
09S KIRRILY	06 FEB - 10 FEB	9	75 (39)	967
10P HARRY	08 FEB - 19 FEB	24	130 (67)	910
11S HANITRA	17 FEB - 28 FEB	23	125 (64)	916
12S GIZELA	18 FEB - 22 FEB	9	65 (33)	976
13P IVY	23 FEB - 01 MAR	13	100 (51)	944***
14P - - - -	24 FEB - 01 MAR	10**	90 (46)	954
15P JUDY	24 FEB - 28 FEB	9**	90 (46)	954
16S - - - -	24 FEB - 25 FEB	3	45 (23)	991
17S MARCIA	03 MAR - 04 MAR	3	35 (18)	987***
18S - - - -	09 MAR - 10 MAR	4	35 (18)	997
19S JINARO	25 MAR - 30 MAR	13	65 (33)	976
20S NED	26 MAR - 31 MAR	19	100 (51)	943
21S KRISSY	30 MAR - 07 APR	18	105 (54)	938
22P KERRY	31 MAR - 02 APR	5	50 (26)	987
23P AIVU	01 APR - 04 APR	8	120 (62)	922
24S LEZISSY	06 APR - 09 APR	6	45 (23)	991
25P LILI	07 APR - 11 APR	10	110 (57)	933
26S ORSON	18 APR - 23 APR	12	140 (72)	898
27P MEENA	03 MAY - 10 MAY	16	50 (26)	987
28P ERNIE	07 MAY - 09 MAY	5	35 (18)	997
28P ERNIE*	10 MAY - 12 MAY	4	30 (15)	1000
	TOTAL	312		

* REGENERATED
** ISSUED BY NWOC
*** BASED ON SYNOPTIC DATA

NOTE: NAMES OF SOUTHERN HEMISPHERE TROPICAL CYCLONES ARE GIVEN BY THE REGIONAL WARNING CENTERS (NADI, BRISBANE, DARWIN, PERTH, REUNION AND MAURITIUS) AND ARE APPENDED TO JTWC WARNINGS, WHEN AVAILABLE.

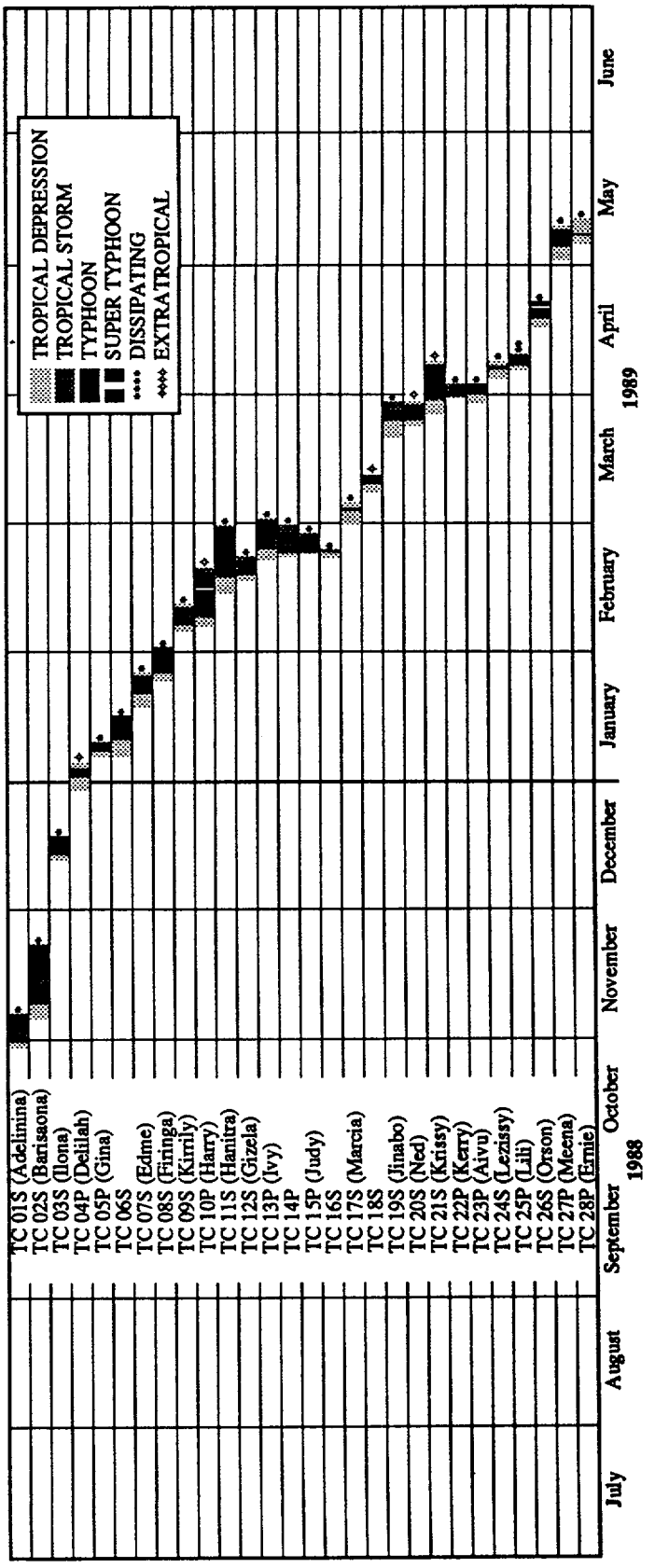

Figure 4-1. Chronology of South Pacific and South Indian Ocean tropical cyclones for 1989.

TABLE 4-3

TROPICAL CYCLONE DISTRIBUTION
SOUTH PACIFIC AND SOUTH INDIAN OCEANS

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
(1959-1978) AVERAGE*	-	-	-	0.4	1.5	3.6	6.1	5.8	4.7	2.1	0.5	-	24.7
1981	0	0	0	1	3	2	6	5	3	3	1	0	24
1982	1	0	0	1	1	3	9	4	2	3	1	0	25
1983	1	0	0	1	1	3	5	6	3	5	0	0	25
1984	1	0	0	1	2	5	5	10	4	2	0	0	30
1985	0	0	0	0	1	7	9	9	6	3	0	0	35
1986	0	0	1	0	1	1	9	9	6	4	2	0	33
1987	0	1	0	0	1	3	6	8	3	4	1	1	28
1988	0	0	0	0	2	3	5	5	3	1	2	0	21
1989	0	0	0	0	2	1	5	8	6	4	2	0	28
TOTAL CASES:	3	1	1	4	14	28	59	64	36	29	9	1	249
(1981-1989) AVERAGE:	0.3	0.1	0.1	0.4	1.6	3.1	6.6	7.1	4.0	3.2	1.0	0.1	27.7

* (GRAY, 1979)

TABLE 4-4

ANNUAL VARIATION OF SOUTHERN HEMISPHERE
TROPICAL CYCLONES BY OCEAN BASIN

YEAR	SOUTH INDIAN (WEST OF 105° E)	AUSTRALIAN (105° E - 165° E)	SOUTH PACIFIC (EAST OF 165° E)	TOTAL
(1959-1978) AVERAGE*	8.4	10.3	5.9	24.7
1981	13	8	3	24
1982	12	11	2	25
1983	7	6	12	25
1984	14	14	2	30
1985	14	15	6	35
1986	14	16	3	33
1987	9	8	11	28
1988	14	2	5	21
1989	12	9	7	28
TOTAL CASES:	109	89	51	249
(1981-1989) AVERAGE:	12.1	9.9	5.7	27.7

* (GRAY, 1979)

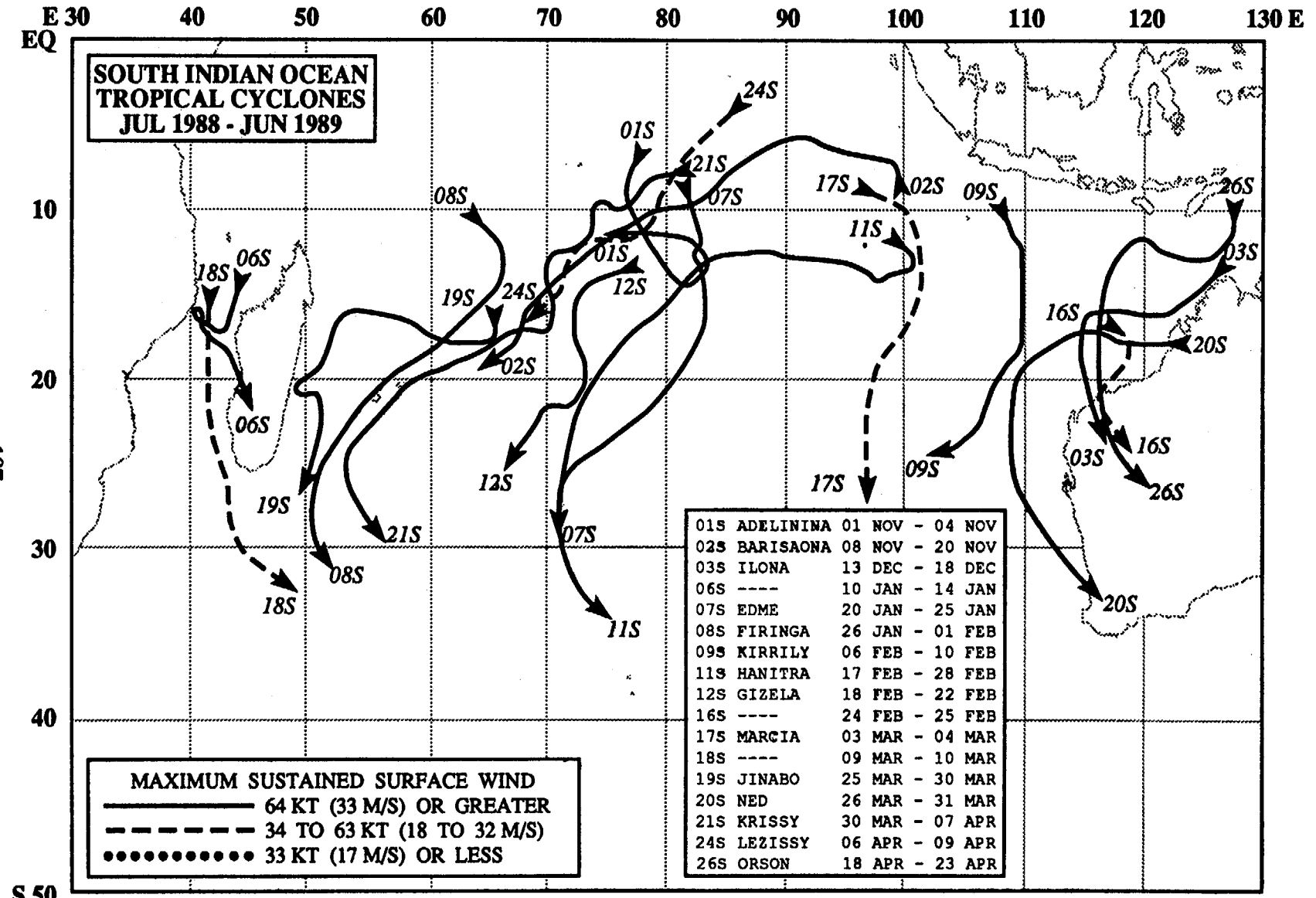
SOUTH INDIAN OCEAN
TROPICAL CYCLONES
JUL 1988 - JUN 1989
E 30
40
50
60
70
80
90
100
110
120
130 E
EQ
10
20
30
40
S 50
197
01S ADELININA 01 NOV - 04 NOV
02S BARISAONA 08 NOV - 20 NOV
03S ILONA 13 DEC - 18 DEC
06S ---- 10 JAN - 14 JAN
07S EDME 20 JAN - 25 JAN
08S FIRINGA 26 JAN - 01 FEB
09S KIRRILY 06 FEB - 10 FEB
11S HANITRA 17 FEB - 28 FEB
12S GIZELA 18 FEB - 22 FEB
16S ---- 24 FEB - 25 FEB
17S MARCIA 03 MAR - 04 MAR
18S ---- 09 MAR - 10 MAR
19S JINABO 25 MAR - 30 MAR
20S NED 26 MAR - 31 MAR
21S KRISSY 30 MAR - 07 APR
24S LEZISSY 06 APR - 09 APR
26S ORSON 18 APR - 23 APR
MAXIMUM SUSTAINED SURFACE WIND
64 KT (33 M/S) OR GREATER
34 TO 63 KT (18 TO 32 M/S)
33 KT (17 M/S) OR LESS

Figure 4-2

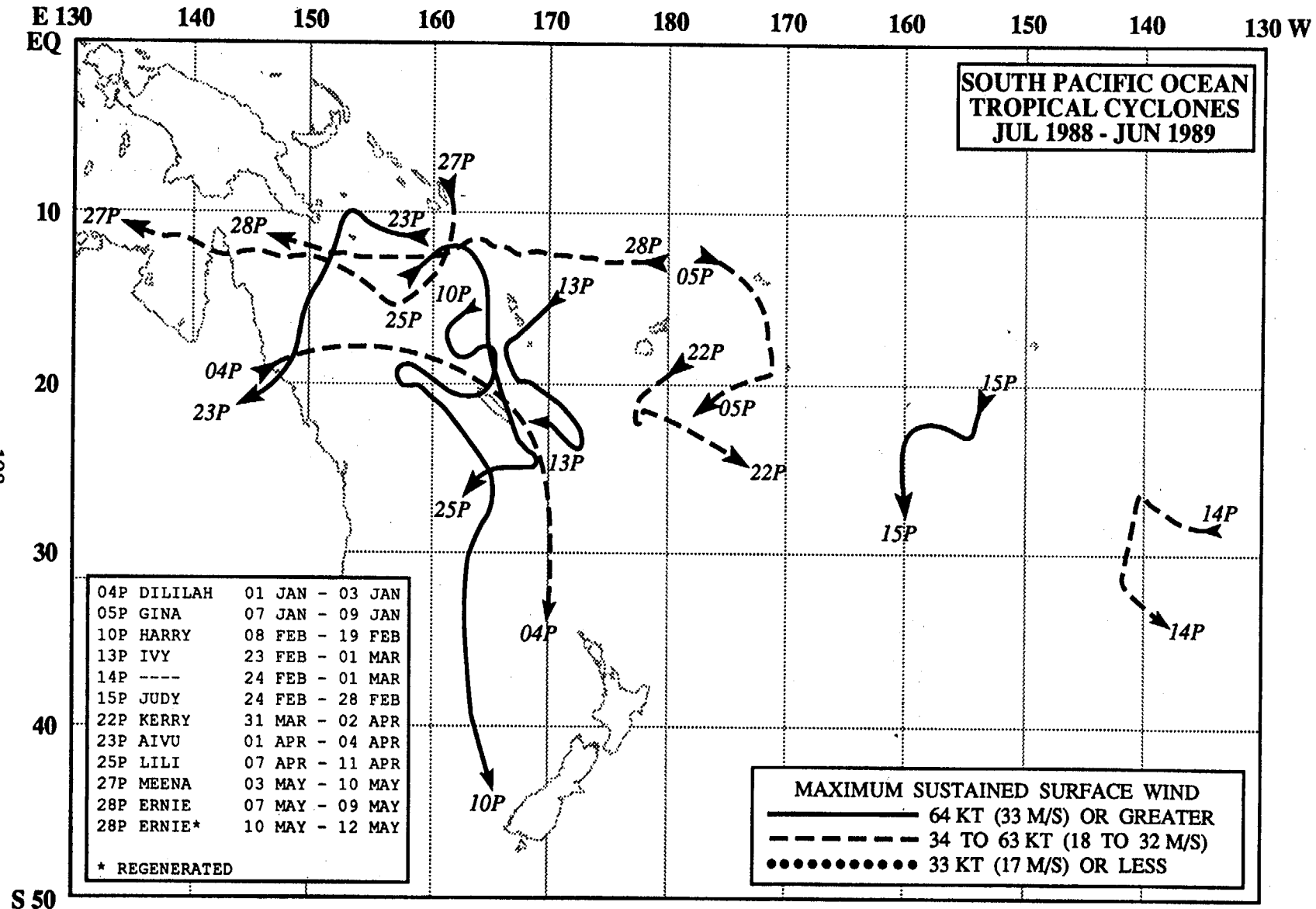
E 130
140
150
160
170
180
170
160
150
140
130 W
EQ
10
20
30
40
S 50
SOUTH PACIFIC OCEAN
TROPICAL CYCLONES
JUL 1988 - JUN 1989
27P
28P
23P
10P
25P
13P
04P
05P
22P
15P
14P
04P DILILAH 01 JAN - 03 JAN
05P GINA 07 JAN - 09 JAN
10P HARRY 08 FEB - 19 FEB
13P IVY 23 FEB - 01 MAR
14P ---- 24 FEB - 01 MAR
15P JUDY 24 FEB - 28 FEB
22P KERRY 31 MAR - 02 APR
23P AIVU 01 APR - 04 APR
25P LILI 07 APR - 11 APR
27P MEENA 03 MAY - 10 MAY
28P ERNIE 07 MAY - 09 MAY
28P ERNIE* 10 MAY - 12 MAY
* REGENERATED
MAXIMUM SUSTAINED SURFACE WIND
64 KT (33 M/S) OR GREATER
34 TO 63 KT (18 TO 32 M/S)
33 KT (17 M/S) OR LESS

Figure 4-3